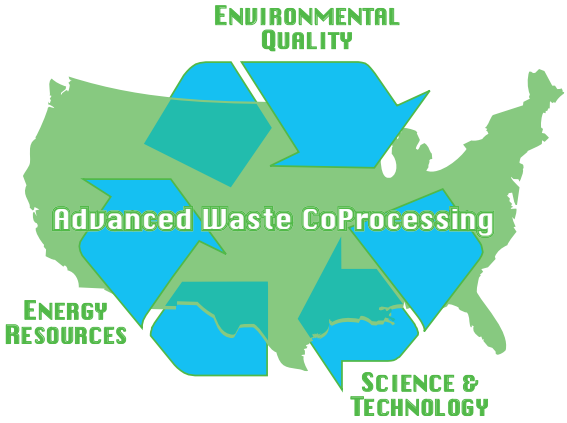
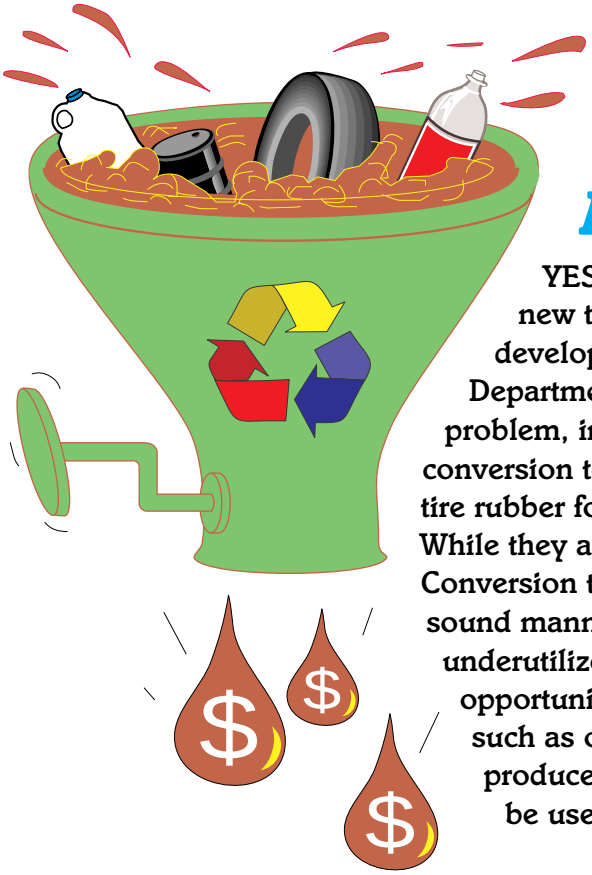
PETC
PITTSBURGH ENERGY TECHNOLOGY CENTER



CONVERTING TRASH TO CASH...



Are There Better Ideas?

YES! We can transform trash into valuable products using new technologies. There are many approaches being developed privately and within programs sponsored by the Department of Energy (DOE) to address the mounting waste problem, including direct use of waste as a fuel and waste conversion technologies. Direct fuel uses such as co-firing (coal and tire rubber for example) are now emerging as commercial processes. While they are becoming part of the answer, we can do better! Conversion technologies can get rid of waste in an environmentally sound manner while generating useful products from lost (and underutilized) waste resources. These approaches offer the opportunity for recycling [in contrast to "one-time" use options such as occurs when wastes are burned to make electricity] to produce a number of beneficial products including feedstocks to be used to make the original materials.

Creating A Better Technology Solution!

One promising approach to the issue of waste disposal applies the extensive experience obtained from the study of heavy oil conversion and coal liquefaction. Coal liquefaction-based technology can convert just about any hydrocarbon waste (plastics, used oil, and tires as examples) into clean, high-value products. This new technology application, known as "advanced waste coprocessing", is similar to what is being done to convert heavy crude oils to useful products (heating oil and gasoline) in refineries. A new

plant for the conversion of wastes would include a feed handling system, a conversion or reaction system, and a product recovery system. On their own, each system is a well understood and reliable technology. Together, in novel combination, a reliable process is created to recycle wastes into fuels and other useful chemicals. These new plants could be built at reasonable costs in strategic locations near our metropolitan areas. Current estimates are that new plants would need to charge just over $30 per ton to process the wastes to be a profitable venture. This is what it costs now, on average, to throw these wastes away at a landfill!

What Are the Alternatives?

Faced with compelling space constraints for landfills, many European countries enacted comprehensive recycling laws known as the Green Dot (Packaging) Requirements. This legislation has proven to be very expensive for industry and in the long-run, is potentially harmful to businesses and employment. Clearly, a more promising approach is needed to accomplish balancing goals for a "greener" environment and continued economic development. To effectively conserve natural resources, we must build on the experiences of others and use our creativity to develop technology solutions that meet these challenging national needs.

For us, there are alternatives. We can continue the trend to dispose of our trash, broadly referred to as Municipal Solid Waste (MSW), in landfills and incinerators further away from urban areas. However, shipping MSW longer distances increases our consumption of fuels and pollutants from mobile sources, resulting in no real environmental or economic gain. An alternative strategy involves the development of new and better disposal options that are designed to recover and reuse significant portions of the MSW waste stream. Advanced waste coprocessing is just such an option!

What are the Incentives?

Disposal of MSW in landfills poses important environmental risks. Landfill dumping costs are an economic liability, ranging from $27/ton to as high as $72/ton for wastes generated in our Northeastern population centers.

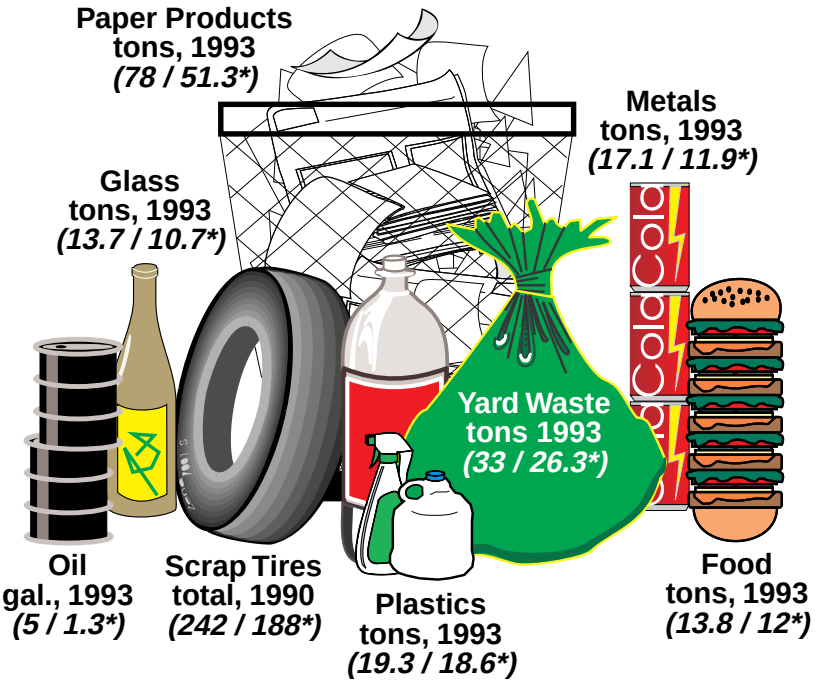
MSW disposal by more advanced waste coprocessing technologies could reduce the amount of material sent to the landfill, lengthening the useful life of existing landfills, and offer the possibility of costing less than landfilling. In addition, this approach would alleviate the environmental and socio-economic issues associated with landfills and produce value-added fuels and chemicals from waste. This would lead to a cleaner environment resulting in further economic growth and gain. Coprocessing technologies represent a more sensible approach to using the full benefit of our natural resources.

Why is our TRASH a Problem?

More than 200 million tons of MSW [trash] is generated each year in the United States. We, as a nation, generate more waste per person than any other country in the world. With continued economic growth and the ever increasing demands placed on packaging, expansion in the volume and type of waste is anticipated. Disposal and use of these wastes presents us with continuing challenges. We have made significant environmental progress—from open pit dumping and burning to more effective combustion, landfill, and recycling initiatives. But combustion and landfilling present air pollution and general health concerns. Much more remains to be done: the U.S. currently operates over 3,500

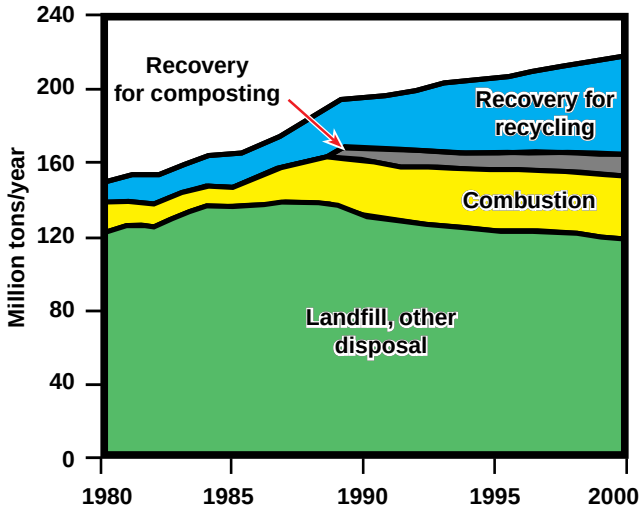
landfills—where about 63% of the total waste we generate ends up. Incineration by 150 operating plants burns another 16% to reduce volume and recover heat energy. In spite of increasing recycling efforts, landfilling continues to be our main approach to waste disposal (enough to cover Manhattan Island the depth of a two-story building each year). Since many existing dumps are filling up fast, licensed landfill space may become scarce, particularly in high-population areas of the country. Stringent environmental regulations may make siting new dumps difficult. Not-in-my-backyard is a common public response to both combustion and landfill approaches, particularly in urban areas of highest need.

Waste in millions, *(generated / disposed*)*



The significant environmental issues confronting landfill and combustion technologies include water and air pollution problems. Air pollutants from landfills and waste combustion include methane and carbon dioxide (which are suspected to contribute to global warming), volatile organic compounds (ground-level ozone precursors), and hazardous air pollutants. Leachate that may seep into potable and surface waters from landfills may contain carcinogens and other harmful chemicals. While modern landfills adequately address many of these concerns, from a long-term point of view, nagging uncertainties remain. Therefore, development of improved waste disposal solutions is an important national priority. Regardless of where we look, and despite our increased attention and commitment, our society has not yet fully addressed solutions to all of our waste disposal issues. We cannot afford, either economically or environmentally, to be wasteful of the earth's natural resources.

Municipal solid waste management, 1980 to 2000*



*Source: EPA Waste Characterization Report, Franklin Assoc., 1994

What Happens to TRASH Now?

Each year we recycle 45 million tons, burn 33 million tons, and bury nearly 130 million tons of MSW.

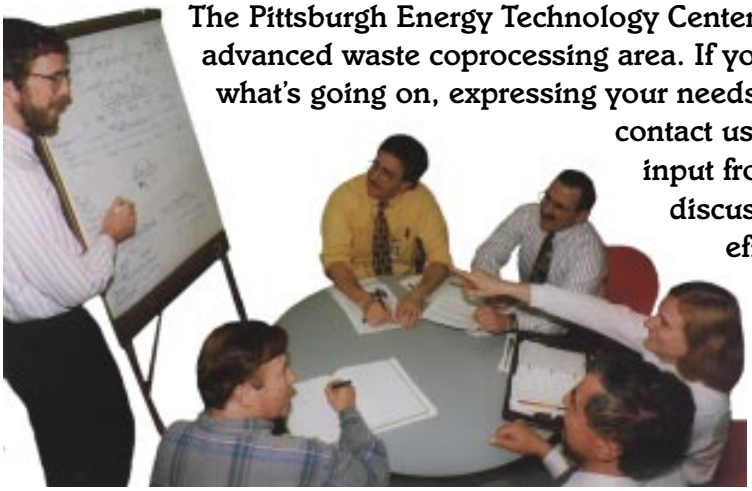
Recycled municipal wastes include items separated by households and put at the curb such as iron and aluminum metals (primarily cans), glass, plastics (primarily soda and milk bottles), and newsprint. These materials are further separated and processed back into consumer goods—supporting a relatively new and growing industry. In a separate effort, industry at large is working hard to recycle materials internal to manufacturing processes to not only reduce costs but to minimize contributions to the waste stream.

Historically, waste was burned in open pits or in moving grate furnaces. Open burning is now illegal and many waste combustors have been or may be shut down due to the emergence of more stringent emission limits. The predominant MSW disposal process is by landfill and this trend is expected to continue. Projections are that in the year 2000 and beyond, we will still be landfilling over 120 million tons of MSW annually.

Achieving Solutions to the Problems?

The role of the DOE is to promote environmental stewardship by taking responsibility for encouraging and coordinating the research and development, while keeping potential end-users aware of the performance results and possible applications. Opportunities for Federal, State, industrial, and municipal research partnerships will be sought and should be formed early-on. These would be maintained and strengthened as the technologies approach commercial readiness. DOE would need to maintain consistent budget support to allow the technologies to emerge. Non-federal cost-sharing would be expected to increase as the technology develops and rise to 50% or more, as small commercial feasibility tests are conducted to prove out the concepts.

How Can I Obtain More Information?



The Pittsburgh Energy Technology Center is coordinating ongoing research in the advanced waste coprocessing area. If you are interested in learning more about what's going on, expressing your needs, or would like to get involved, please contact us. We are especially interested in receiving input from potential users. A "round-table" discussion format is proving to be especially effective. In this way, members of our team can visit and participate in "to-the-point" discussions with individuals, groups, and organizations. We would be happy to receive an invitation from your organization to discuss this important research initiative.

If you would like to participate in or organize a round-table, please contact:

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